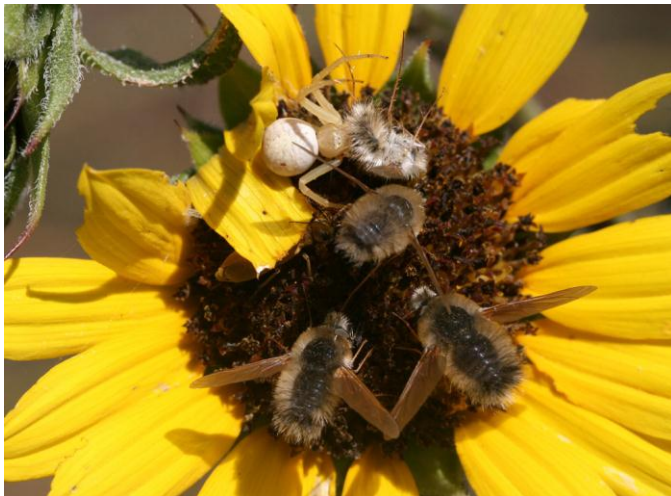
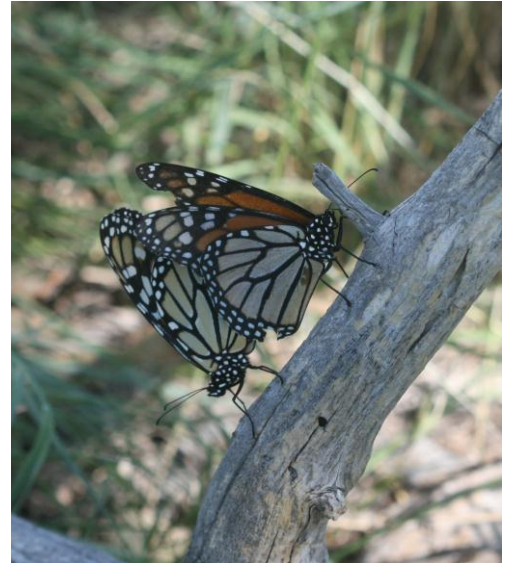


The Insects of the Sand Creek Massacre National Historic Site

Kiowa County, Colorado



Boris Kondratieff and Whitney Cranshaw

Site Description: Sand Creek Massacre National Historic Site

On April 28, 2007, Sand Creek Massacre National Historic Site (SAND), Colorado, the 391st unit of the National Park Service was dedicated. The new Park was established to commemorate and preserve the site of the Sand Creek Massacre that took place on the morning of November 29, 1864, where 650 Colorado volunteers attacked an encampment of Cheyenne and Arapaho, resulting in the deaths of over 160 of the villagers.

The Sand Creek Massacre National Historic Site is located approximately 290 km southeast of Denver in Kiowa County, Colorado in the Great Plains Physiographic Province. This region has a gently sloping landscape that extends over the eastern two-fifths of Colorado and was once characterized by vast grasslands of perennial plants dominated by a mixture of blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). Much of this vegetation has been impacted by cattle grazing or replaced by agronomic crops such as wheat, sunflowers, corn, and alfalfa. Some mesa tops, steep hillsides and flood plains still retain native assemblages of grasses and forbs. Shrubs such as rabbitbrush (*Chrysothamnus nauseosus*), four-winged saltbush (*Atriplex canescens*), and pasture sagebrush (*Artemisia frigida*) have become abundant in many old fields and pastures. Other distinctive features of the plains are scattered pockets or areas of sand hills or blowouts, and several extensive sand ridges associated with stream courses. Characteristic plants of these sandy areas are sandhill muhly (*Muhlenbergia pungens*), blowout grass (*Redfieldia flexuosa*), heliotrope (*Euploca convolvulacea*), and sand sagebrush (*Artemisia filifolia*).

This area of eastern Colorado is typified by hot to extremely hot summers. Between June and September, daytime temperatures can exceed 37°C. Rainfall is often spotty, but brief summer downpours may occur. Embedded thunderstorms, while rare, can occur spring through fall. Winter temperatures in southeastern Colorado can range from cool to extremely cold. Readings of below -17 °C, while infrequent, do occur. Severe winter storms, with blowing and drifting snow may occur between late October and mid-April.

Big Sandy Creek, originating near the Kit Carson and Cheyenne County border, is an ephemeral drainage that flows southeastward paralleling County Route 45.5 through Lincoln County and US 287 in Cheyenne County and finally southward through Kiowa County and Prowers County, where it joins the Arkansas River 12 km east of Lamar, Colorado. In recent times, stream flow only occurs in certain reaches during major precipitation events in spring and summer. The stream is usually dry throughout the winter, except for small pools. The flood plain is wide and shallow through most of its length with short sections of gallery forest composed of Great Plains cottonwood (*Populus deltoides* var. *occidentalis*). Within the SAND, pools of various sizes and depths occur along the Big Sandy Creek to County Road W. At the northern boundary are remnants of the Chivington Canal, which also contains pools that are 1 to 2 m in depth. These pools are often surrounded in part with cattail (*Typha latifolia*) and many are nearly filled with detached Russian thistle (*Salsola iberica*). Several of the pools have robust populations of native minnows, such as Northern Plains killifish (*Fundulus kansae*) indicating permanency.

Table of Contents

Site Description: Sand Creek Massacre Historic Site	i
--	----------

Darkling Beetles	1
Ground Beetles	2
Tiger Beetles	3
Blister Beetles	4
Soldier and Netwinged Beetles	6
Scarab Beetles	7
Milkweed Longhorns	8
Cactus Longhorn	9
Whiteline Sphinx	10
Blue Cactus Borer	11
Saltmarsh Caterpillar	12
Monarch	13
Common Butterflies of SAND	14
Robber Flies	16
Bee Flies	18
Bumble Bees	19
Digger Bees	20
Harvester Ants	21
Velvet Ants	22
Hunting Wasps	23
Antlions	24
Meadowhawks/Skimmers	25
Darners	26
Damselflies	27
Dog-day Cicadas	28
Bee Assassin	29
Milkweed Bugs	30
Grasshoppers	31
Katydid	33
Prairie Walkingstick	34
Ground Mantid	35
Aridland Subterranean Termite	36
Rocky Mountain Wood Tick	37
Banded Garden Spider	38
Common Desert (Tiger) Centipede	39

Darkling Beetles

At least 15 species of darkling beetles occur at Sand Creek Massacre National Historic Site and most are fairly nondescript dark beetles typically wondering about the grasslands or sandy roads. They also can commonly be found under rocks or wood debris.

The most common group of darkling beetles are of the genus *Eleodes* with at least six species locally represented. The larger species (e.g., *E. hispilabris*, *E. suturalis*) can be greater than 2.5 cm long. However, more commonly encountered species (e.g., *E. carbonarius obsoletus*, *E. extricatus*) are smaller. A distinctive species is *E. fusiformis* which has a distinctive elliptical shape.



Eleodes hispilabris feeding on a fallen flower petal.



Eleodes carbonarius scavenging a dead grasshopper.



Bothrotes plumbeus.



Eleodes fusiformis.

Adults are primarily night active. However, several of the *Eleodes* may be seen wandering during the day and *Bothrotes plumbeus* is a common darkling beetle found resting on plants. Larval stages of darkling beetles occur in soil where they feed on roots and germinating seeds. Adults primarily scavenge dead plant matter.

Coleoptera: Tenebrionidae

Ground Beetles

Most ground beetles are black and shiny with prominent jaws that project forward from the head. Along with the darkling beetles, they are the most commonly observed beetles seen crawling across the ground, although most are more active at night. Ground beetles may often be found under logs or rocks and some species fly well and come to nighttime lights.

Both the adults and larvae are active insects and most develop as predators, feeding on insects and other invertebrates. Several groups of ground beetles are common along edges of water, including those that specialize in snails. Others are restricted to the grasslands. Approximately 62 species of ground beetles (not including tiger beetles) have been collected on Sand Creek Massacre National Historic Site.



Harpalus caliginosus.



Pasimachus californicus (top); *Pasimachus elongatus* (bottom).



Harpalus pensylvanicus. Photograph courtesy of Jim Kalisch, University of Nebraska.

Coleoptera: Carabidae

Tiger Beetles

Tiger beetles are active insects, readily disturbed to flight or running. Many are brightly colored, often with iridescent blue or green, and may have bold patterning.

Six species of tiger beetle are known to occur at the Site. The most commonly seen is the **sidewalk tiger beetle**, *Cicindela punctulata*. Also common is a vibrantly colored species known as the **splendid tiger beetle**, *C. splendida*. Perhaps the most unusual species is the **Great Plains giant tiger beetle**, *Amblycheila cyndriformis*, a large flightless black beetle (up to 36 mm in length) with large jaws that hunts at night.

Tiger beetle adults are predators of insects on the open ground. Most commonly these beetles will ambush their prey, darting out of shaded areas. Larvae construct vertical burrows in the soil where they sit and wait for unsuspecting prey to come within grasping range.



Top: Sidewalk tiger beetle.
Bottom: Splendid tiger beetle.



Cicindela obsoleta.



Tiger beetle larva. The larvae are found within tunnels they construct in soil and they feed on passing insects.

Coleoptera: Carabidae (Cicindelinae)

Blister Beetles

Blister beetles are moderate to large size beetles most often seen at flowers and sometimes found feeding on leaves of legume family plants. Unlike most beetles, the wing covers of the blister beetles are relatively soft and flexible, and a wide head with a short “neck” separate them from the other common families of beetles with soft wing covers that occur at the Site - Cantharidae (soldier beetles), Lampyridae (lightning bugs or fireflies), and Lycidae (netwinged beetles). Most blister beetles are black, brown, or gray but some are brightly colored and may be striped.



Epicauta pensylvanica, the black blister beetle.

Larvae of blister beetles feed below ground and are predators of specific insect groups. Larvae of *Epicauta* species of blister beetles feed on the eggs of grasshoppers, mainly *Melanoplus* species. Adults lay eggs in areas of soil where grasshopper egg pods may be present. Larvae of other genera of blister beetles feed on the stored food and larvae of ground nesting digger bees (subfamily Anthophorinae) and or leafcutting bees (Megachilidae). Adults of these species lay eggs on flowers and young, active first stage larvae (triangulins) attach to visiting bees.

The name “blister beetle” relates to a chemical defense present in the blood (cantharidin) that, in sufficient concentration, can raise skin blisters. When threatened, adults will secrete clear droplets that can effectively deter most predators. Some species that have high concentrations of cantharidin occasionally cause problems in alfalfa grown in southeastern Colorado when they are accidentally incorporated into hay at harvest, posing a serious poisoning threat to cantharidin susceptible livestock, such as horses.

About 14 species of blister beetles have been found on Sand Creek Massacre National Historic Site. The collection of *P. discoidea* at Sand Creek Massacre National Historic Site represented a new state record for Colorado. The largest blister beetles found on the Site are *Epicauta immaculata*, a gray to orangish species and *E. valida*, a black, flightless blister beetle.



The discovery of *Pyrota discoidea* at the SCMHS constituted a new state record for this species.



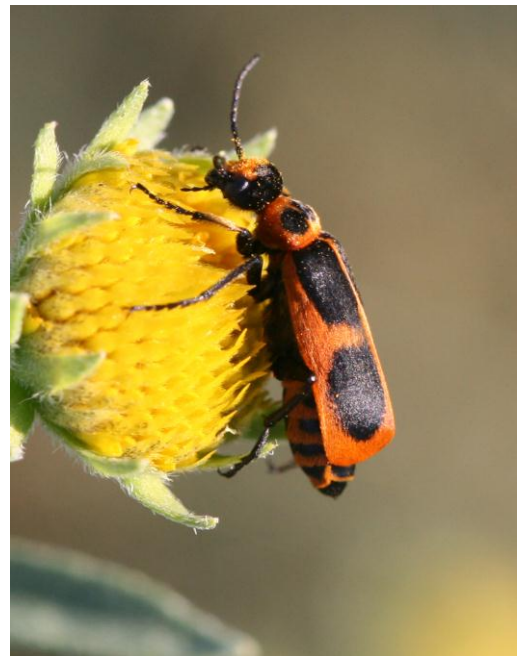
Epicauta immaculata.



Epicauta valida is one of the larger blister beetles and is flightless.



Epicauta sp.



Epicauta stuarti.

Coleoptera: Meloidae

Soldier and Netwinged Beetles

Soldier beetles and netwinged beetles are brightly colored, orange and black beetles with soft wing covers. They are frequently seen at flowers in late summer where they feed on pollen. Often they are seen as mating pairs, particularly soldier beetles.

The life history of these common insects is poorly understood. The larvae are predators of other insects and occasionally may be found crawling across the soil or exposed when turning over a piece of wood.



Mating pair of the soldier beetle *Chauliognathus basalis*.



Pupal skins and adults of the banded netwinged beetle *Calopteron reticulatum* exposed under a log.



The banded netwinged beetle, *Calopteron reticulatum*.

Coleoptera: Cantharidae, Lycidae

Scarab Beetles

Scarab beetles comprise a conspicuous component of Sand Creek Massacre National Historic Site's beetle fauna and at least 27 species are present. Adults tend to be rather large beetles, with a heavy body form. Their front legs are thick and conspicuously spiny and are used for digging. Most scarabs are black or brown and are night active; many are attracted to night-time lights. Others are brightly patterned and colored, including those associated with flowers.



Common flower scarabs (*Euphoria kernii*).

Scarab larvae are known as 'white grubs', and have a C-shaped form with a brown or reddish-brown head. Some feed on plant roots but many are scavengers of manure and decaying plant or animal matter.



Phyllophaga hammondi.



Phyllophaga lanceolata.

Coleoptera: Scarabaeidae

Milkweed Longhorns

Tetraopes annulatus, *T. discoideus*,
and *T. femoratus*

The milkweed longhorns are conspicuous red beetles with black markings associated with the foliage and blossoms of various species of milkweed (*Asclepias* spp.). These host plants are concentrated in the wetter areas at the Site. The most common milkweed longhorn is *Tetraopes femoratus*, which is about 2.0 cm, but also present is the smallest member of the genus, *T. annulatus*, an uncommonly collected species in Colorado.



Tetraopes femoratus.



Tetraopes annulatus.

Larvae of the milkweed longhorns develop as root borers of the same plants on which the adults feed.

Coleoptera: Cerambycidae

Cactus Longhorn (Opuntia Borer)

Moneilema annulata

The **opuntia borer** is one of the “cactus longhorns” that develop as borers of various prickly pear (*Opuntia*) and tree cholla (*Cylindropuntia*) cacti. It is a black, shiny beetle, incapable of flight, which may be found resting on cactus pads from late spring through summer. They may blend well with the dark sap that forms around feeding wound that they produce.

The beetles feed at night typically eating young cactus pads or oozing sap. After mating, the females glue eggs to the cactus pad. The young larvae attempt to tunnel into the cactus, causing the plant to ooze sap at the wound. The young larvae first feed in this ooze, later entering the plant where they complete their development feeding within the cactus pad. They transform to the pupal stage in spring and adults emerge in late spring and early summer.



Moneilema annulata/

Coleoptera: Cerambycidae

Whitelined Sphinx

Hyles lineata

The **whitelined sphinx** is the most common “hummingbird moth” of the Colorado prairie. Adults may be seen hovering and feeding at flowers, much in the manner of a hummingbird, drawing out the nectar with their long tube-like mouthparts. The adult whitelined sphinx is also distinctly marked with a strong white band running through the center of the front wing, making it one of the more easily recognizable insects. Adults may be seen from March to September and are most active in the daytime when there is some cloud cover or as dusk approaches.

The caterpillar of the whitelined sphinx is highly variable in patterning; it is usually bright yellow green but some forms are bluish black with rows of whitish to yellowish spots. A dark green or black “horn” tips the abdomen. The caterpillars feed on a wide variety of plants including willow weed, four-o’clock, purslane, elm, and grape.



Whitelined sphinx visiting sunflower.



Full grown caterpillars of the whitelined sphinx showing range of coloration.

The whitelined sphinx is a member of the moth family Sphingidae, variously known as “sphinx moths” or “hawk moths” with caterpillars collectively called “hornworms”. Also common at SAND is the **fivespotted hawkmoth** (*Manduca quinquemaculata*), the larvae of which are known as the **tomato hornworm**. Caterpillars of this species feed on plants in the nightshade family. Like most moths in the family, the fivespotted hawkmoth flies only at night and is not seen in the day.

Lepidoptera: Sphingidae

Blue Cactus Borer

Melitara dentata

The presence of the **blue cactus borer** is often indicated by the presence of yellowed, dying pads of prickly pear. These unusually colored caterpillars are a dark metallic blue. They are often found feeding in groups within the cactus pads.

The caterpillars become full-grown in late spring then wander in search of a protected site in which to pupate. Adults are present in mid-summer and eggs are subsequently laid in the form of “egg stick” masses on the needles of the host plant.



Blue cactus borer larvae at base of prickly pear.



Prickly pear showing evidence of infestation by the blue cactus borer.



Adult of the blue cactus borer.

Lepidoptera: Pyralidae

Saltmarsh Caterpillar/Acrea Moth

Estigmene acrea

One of the more commonly observed caterpillars found at the Site is the **saltmarsh caterpillar**. It is a very hairy caterpillar, highly variable in coloration, and is one of the “woollybears” that get their name because they are so often found wandering on plants or across the soil surface. They may be found almost everywhere as the caterpillars have a very wide range of host plants on which they may feed.



Saltmarsh caterpillar.



Adults of the saltmarsh caterpillar, the Acrea moth. Males are at the top, females below.

Adults of the saltmarsh caterpillar are white moths with black spotted wings, known as “Acrea moths”. They are rarely seen during the day but will readily come to lights in late spring and summer.

Lepidoptera: Erebidæ (Arctiinae)

Monarch

Danaus plexippus

The monarch is perhaps the best known of the North American butterflies and it is a regular visitor and summer resident at the Site. It is a large and showy butterfly with upper wings marked with orange and black. The underwings have more muted markings and can provide camouflage among foliage.



Monarch butterfly. Photograph courtesy of Jim Kalisch, University of Nebraska.

Monarchs may often be seen visiting flowers or passing by in flight from June through September, but are concentrated in the wetter areas where various wild milkweeds grow. Milkweeds are the host plants on which the caterpillars feed and milkweed caterpillars are as brightly colored as the adults. These bright markings indicate that monarchs are well defended against most potential predators due to their ability to acquire and concentrate toxic chemicals (cardiac glycosides) from their host plants.



Caterpillar of the monarch butterfly.

The monarch is only a temporary resident at SAND, as it is elsewhere in the US. New populations arise annually from migrants arriving in late spring. In late summer they make a return pilgrimage to a small area in south central Mexico which serves as the overwintering site for all the Monarchs that are found east of the Rocky Mountains. There they settle in forested areas of the Monarch Butterfly Biosphere Reserve, located in the mountains of Michoacan and Mexico states, where they stay dormant during the winter months. Because of its ubiquitous presence in summer, SAND has started supporting Monarch Watch by encouraging staff and volunteers to tag monarchs every summer during their southward migration.



Mating pair of monarch butterflies.

Lepidoptera: Nymphalidae

Butterflies at the SAND

Several other butterflies may also be seen at the Site, some of which are illustrated below.



Male (top) and female (bottom) of the Melissa blue (*Plebejus melissa*), one of the most common butterflies at the Site. Larvae feed on various legumes.



The painted lady is an annual migrant into the state. Larvae most often are found feeding on leaves of thistles, sunflowers, or mallow family plants.



The alfalfa butterfly (*Colias eurytheme*) is the most common yellow-colored butterfly. Caterpillars feed on various legumes.



The gray hairstreak (*Strymon melinus*). Larvae feed on many different plants, particularly legumes and mallows.



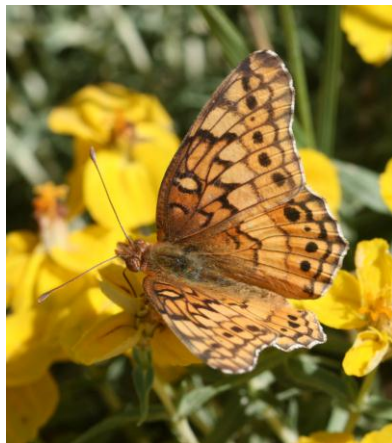
The checkered white (*Pontia protodice*). Larvae feed on various mustard family plants.



Mating pair of the common checkered skipper (*Pyrgus communis*). Larvae feed on various mallow family plants.



The dainty sulfur (*Nathalis iole*). Larvae feed on low growing plants of the aster family.



The variegated fritillary (*Euptoieta claudia*). Larvae feed on wild flax and many other plants.

Robber Flies

For much of the summer and early fall robber flies largely rule the air space. Several species are large (2-3 cm) and conspicuous as they are frequently stirred when walking across the grasslands. Other species concentrate in the wooded areas. To date, 25 species of robber flies have been collected on the Site.

Most robber flies are gray or brown with a very elongated abdomen. Adult robber flies are visual predators and possess large eyes. They are typically seen as they perch on plants scanning the local area for potential prey, mates or rivals. When an insect of interest jumps or flies nearby, they dart out quickly. Prey are grabbed with their basket-like legs and rapidly incapacitated by injecting paralyzing venom with dagger-like mouthparts. Various flies (including smaller robber flies), bees, beetles and moths are common prey.

The tip of the abdomen on females tapers to a fine point and is used to insert eggs into soil cracks or other sites where their young develop. Larvae of robber flies dwell in the soil or decaying wood and are predators, but the ecology of the immature stages is poorly known. The abdomen of male robber flies is tipped with bulbous claspers used for grasping females during mating and paired robber flies may be commonly seen.



Proctacanthella cacopiloga, female/



Sarcopogon combustus female feeding on tiger beetle/



Ospricerus minos, female/



Scleropogon picticornis, female/



Diogmites angustipennis, male/



Promachus bastardii (male) with fly prey.



Diogmites angustipennis emerging from is pupal case.

Diptera: Asilidae

Bee Flies

Bee flies are among the most common insects seen on flowers at the Site. Many are mimics of other insects, often with hairy bodies and markings of bees or wasps. Some carry the resemblance even further and buzz.

However, despite their appearance the habits of bee flies are very different from bees. Although adults take nectar from plants, the larvae of many species apparently develop as predators of ground nesting bees and wasps. Bee flies may be seen hovering about the tunnel entrance where these insects nest, and the adults drop their eggs nearby. Upon hatch, the bee fly larvae migrate in search of the developing bee larvae below ground, which they consume.



Anastoechus barbatus/



Systoechus sp. bee flies at flower. A *Mismuena* sp. of crab spider is feeding on one at the top of the photo.



Exoprosopa sp.

Diptera: Bombyliidae

Bumble Bees

Bumble bees are robust, very hairy bees, ranging in size from 1.5-3.0 cm. The most commonly seen species are black with yellow or white markings, but some bumble bees are marked with orange or red. They are frequently observed visitors to flowers throughout late spring and summer and are important pollinators of many native plants. Five species of bumble bees have been recorded from the Site: *Bombus fervidus*, *B. morrisoni*, *B. nevadensis*, *B. pensylvanica*, and *B. griseocollis*.



Bombus morrisoni/

Bumble bees are social insects that produce a small colony. Most bumble bees nest in or on the ground using abandoned rodent burrows. They may also establish nests in old bird nests or other sites that have some insulating materials they can use to surround the nest. New colonies are established each spring by large overwintered queens, that were fertilized the previous fall.



Bombus fervidus/

Throughout the summer the colony increases in size and may contain a hundred or more individuals by the fall.. Towards the end of summer reproductive forms are produced, potential queens and males which mate in late summer. In fall the fertilized females (future queens) scatter in search of sites for winter protection. The remainder of the colony members die and the nest is abandoned.



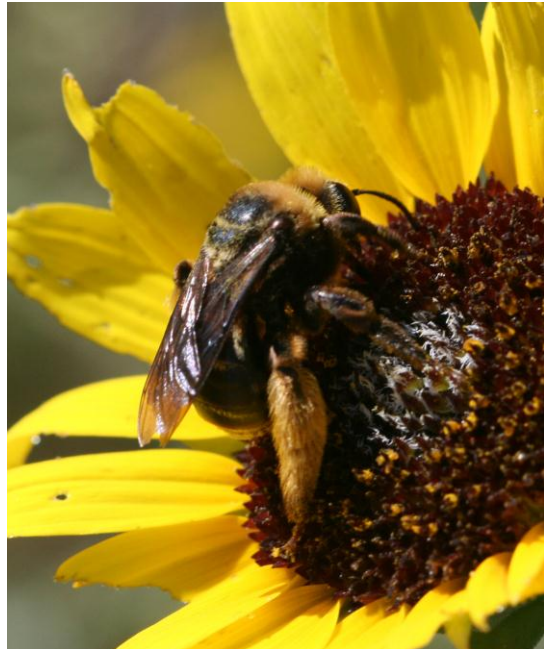
Bombus nevadensis/

Hymenoptera: Apidae

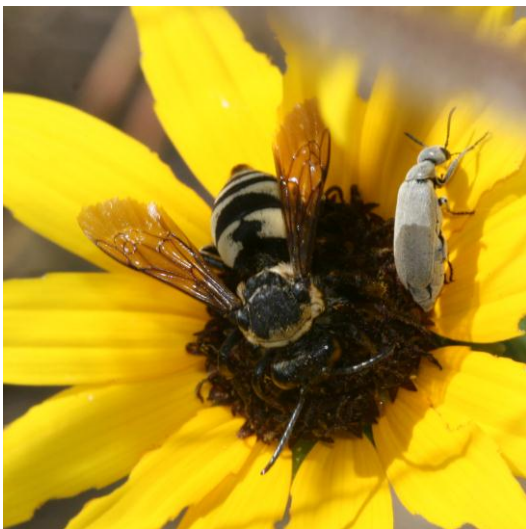
Digger Bees

The most commonly encountered bees at the Site are various digger bees. These nest in soil and a digger bee nest consists of a central tunnel with side chambers dug out, often extending 20-30 cm into the ground. The female provisions each nest cell with a mixture of pollen and nectar on which the larvae feed and develop.

These are a type of solitary bee that do not produce a colony (as do bumble bees). Instead each female establishes and maintains her own nest. However, they are quite particular about selection of nesting sites and multiple bees may sometimes be seen nesting in a small area where conditions of soil texture, slope and orientation are favorable. Females are capable of producing a mildly painful sting, but they are not aggressive and will sting only if confined against the skin.



Savastra obliqua/



Triepeolus sp. digger bee and blister beetle/



Melissoides sp.

Hymenoptera: Apidae (Anthophorinae)

Harvester Ants

Pogonomyrmex species

The nests of harvester ants are distinctive features of the prairie consisting of large mounds of small gravel with a cleared area extending around the base. These are moderately large ants either uniformly rusty-brown or brown and black.

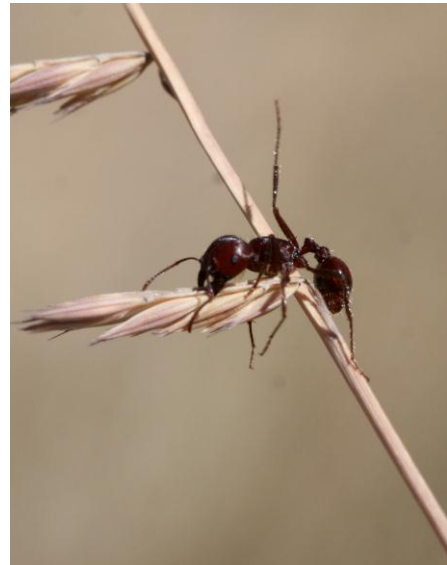
The great majority of the colony includes wingless workers and harvester ant workers are of uniform size. Winged forms are reproductive males and females that make up a small fraction of the colony population. Winged stages are periodically pushed out of the colony for mating flights, usually a warm, calm day in summer a few days following heavy rainfall event. Large balls of harvester ants on the soil may be seen during mating.

Harvester ants feed on seeds that they carry back to the nest and crack open. Nests are dug deep into the soil and they typically bring large amounts of soil and small stones that they pile with other debris at the surface. Multiple entrances may be present but most often the primary entrance is oriented SE, allowing early morning warming.

The harvester ant is capable of producing a very painful sting. However, the stinger is blunt and may not be able to penetrate thicker skin. The species *Pogonomyrmex occidentalis* is the predominant harvester ant on the Sand Creek Massacre National Historic Site. At least 7 other species of ants also are present.



Harvester ants at nest entrance/



Harvester ant collecting seeds/



Mating ball of winged harvester ants/

Hymenoptera: Formicidae

Velvet Ants

Velvet ant females are wingless wasps that often may be spied crawling rapidly across the soil or over low growing plants. Typically they are hairy bodied and brightly colored with orange, yellow or red. The winged males have a quite different appearance and are most often seen resting on plants or feeding on nectar from flowers. At least 26 species of velvet ants occur on the Site.



Velvet ant (*Dasymutilla* sp.), female/



Velvet ant (*Dasymutilla* sp.), female. Two ants are also in this picture.

Velvet ants develop as parasites of solitary bees and wasps that nest in soil. Females enter the burrow of the host insects and lay eggs among the developing young; the velvet ant larvae consume the young bees/wasps.

Female velvet ants, if handled, can produce a very painful sting. The winged males lack a stinger.



Velvet ant (*Dasymutilla quadriguttata*), male/

Hymenoptera: Mutillidae

Hunting Wasps

A large percentage of the wasps seen visiting flowers at the Site are some species of hunting wasp. Each species specializes in hunting certain insects (or spiders) that they capture and paralyze. The prey is then taken back to a nest and used for rearing young.

Hunting wasps nests may be constructed in various locations. Most species nest in soil and, along with the various ground nesting bees, hunting wasps are responsible for most of the small holes dug into the soil. Other species nest in small cavities in rocks or wood or excavate the pith from plants and nest in stems. A few, notably the black-and-yellow mud dauber, make nests of mud.



Ammophila spp. hunting wasps specialize in capture of naked caterpillars. Six species of *Ammophila* wasps occur at SAND.



Cicada killer wasps (*Sphecius* spp.) are the largest hunting wasps and specialize in hunting dog-day cicadas. Photograph courtesy Howard Ensign Evans.



Podalonia valida, a hunting wasp that specializes in hairy caterpillars, such as the saltmarsh caterpillar.



Male hunting wasps may sometimes be seen resting overnight in groups, known as a lek. This lek consists primarily of *Stizoides renicinctus*.

Hymenoptera: Sphecidae, Crabronidae

Antlions

Brachynemurus abdominalis, *B. nigrilabris*

Adult antlions have a very elongated body and delicate wings crossed with numerous veins. They superficially resemble damselflies but can be distinguished by having prominent clubbed antennae and the habit of folding their wings rooflike over their back when at rest. Adults are sometimes seen when disturbed to flight while walking through grassy areas, but are most active at night. Antlions will commonly come to nighttime lights.

Larvae, sometimes known as ‘doodlebugs’, are stout bodied with prominent curved jaws. Antlion larvae hide in soil and are not normally seen but species that produce pits will locate these in areas where soil is loose and there is some overhanging cover to protect them from rainfall. Larvae develop as predators, lying in ambush for passing insects.



Female antlion adult, *Brachynemurus* sp.



Antlion larva.

Neuroptera: Myrmeleontidae

Meadowhawks/Skimmers

Meadowhawks are the most commonly encountered dragonflies at the Site, present around all the pools of Big Sandy Creek or “hawking” about nearby grasslands. Many species have wings marked with spotting or banding and they typically have an erratic flight. Common species found at the site include the **widow skimmer** (*Libellula lutuosa*), **twelve-spotted skimmer** (*L. pulchella*), **variegated meadowhawk** (*Sympetrum corruptum*), **whitefaced meadowhawk** (*S. obtrusum*) and **eastern pondhawk** (*Erythemis simplicicollis*).

Larvae develop in pools of water and are squat-bodied, dappled in greens and browns. They are predators of other aquatic insects, sprawling on the bottom near the base of plants and lying in ambush.

Several species of skimmers found at the Site are of special note. The **bleached skimmer** (*Libellula composita*) is a localized species of eastern Colorado and regionally uncommon. The **desert whitetail** (*Plathemis subornata*) is considered a western species associated with desert alkaline pools, ponds and slow streams and its presence at the SCMHS constitutes an unusually eastern record.



Top: Twelve-spotted skimmer. **Bottom:** Widow skimmer. Photographs courtesy of David Leatherman.



Erythemis simplicicollis, the eastern pondhawk.

Odonata: Libellulidae

Darners

The darners are large dragonflies with bluish eyes and a mosaic pattern of stripes or spots on the abdomen. Adults commonly stay near ponds patrolling along the edges, defending territories and searching for mates and prey. However, they are strong fliers and those found near the pools may easily be migrants from distant sites where the nymphs can be found. Two species are common at Sand Creek Massacre National Historic Site, the **common green darner** (*Anax junius*) and **blue-eyed darner** (*Rhionaeschna multicolor*).

Larvae have a streamlined body striped or spotted with green and brown. They are climbers that search for prey among the tangles of plant stems and dead plants. They typically have a life cycle that extends for more than a year, although it may be completed in a single year with warm temperatures and abundant prey.



Blue-eyed darner, male. Photograph courtesy of David Leatherman.



Mating pair of blue-eyed darners.



Common green darner.



Nymphal skins of the common green darner following adult emergence.

Odonata: Aeshnidae

Damselflies

Adult damselflies are slender insects, about 5-7 cm, that often are considerably smaller and more delicate than their dragonfly relatives. Both the front and hind wings are of the same shape and size and these are held erect over the body at rest. Adults usually remain near water and are predators of small flying insects that they capture in flight.

Immature stages have a long and skinny body and 3 fan-like gills protruding from the hind end. The larvae are predators of small insects and other arthropods that they grab with their extensible lower jaw. Most species crawl about for prey, searching amongst underwater plants and other submerged debris.

A commonly noted behavior among damselflies and dragonflies involves their mating. Often damselflies are paired, with claspers at the tip of the male's abdomen grasping the female behind the head. Mating occurs when the female then curls her abdomen to contact the sperm pouch for egg fertilization ('wheel position'). However, even after mating the male typically continues to clasp the female and they fly in tandem, a practice that prevents subsequent mating.



Mating pair of the familiar bluet (*Enallagma civile*) in the "wheel position".



Lyre-tipped spreadwing. Photograph courtesy of David Leatherman.

At least seven species of damselflies are found around the pools of Big Sandy Creek. Most common are members of the pond damsel/narrowwinged damselflies (Coenagrionidae) including the **familiar bluet** (*Enallagma civile*) and the **eastern forktail** (*Ischnura verticalis*). The **black-fronted forktail** (*Ischnura denticollis*) is a species of western marshes and springs and is considered uncommon in Colorado. Another larger damselfly that can be common around the fishless pools is the **lyre-tipped spreadwing** (*Lestes unguiculatus*) a representative of the spreadwinged damselflies (Lestidae family).

Odonata: Coenagrionidae, Lestidae

Dog-Day Cicadas

Tibicen spp.

Dog-day cicadas are large blunt-bodied insects about 2-3 inches long with clear wings. They are generally black and green, but are marked with lighter banding and patches of many colors. The old larval skins from which they emerge are light brown, somewhat humped and have legs that are thickened to allow digging. The old skins remain loosely attached to the surface where the adults emerged.

Adults of *Tibicen dealbata* are found on cottonwoods, whereas the **giant grassland cicada** (*T. dorsata*) can be found in grassy areas throughout Site. Also present in the among the rangeland shrubs are two other cicada species, *T. bifida* and *Okanagana synodica*.

Cicadas develop below ground, sucking sap from the roots of trees and shrubs. The larvae develop slowly and likely require two to five years to become full-grown. When they have finished feeding, they dig to the surface and crawl onto tree trunks, shrubs or other nearby surfaces. The winged adult then emerges through a split along the back. It is pale-colored at first and then darkens as the new exoskeleton hardens.



Nymphal skin of a dog-day cicada left after molting to the adult form.

Adults typically live in the canopy of trees for a few weeks. The males produce loud songs, a droning buzz that is typical of the 'dog-days' of midsummer. Cicada singing is used to attract females that, after mating, will insert eggs into twigs.

When the eggs hatch the tiny, newly emerged cicadas drop to the ground and dig into the soil to roots.



Tibicen dorsata.



Tibicen dealbata recently emerged from nymphal skin. Photograph courtesy of Howard Ensign Evans.

Hemiptera: Cicadidae

Bee Assassin

Apiomerus spissipes

The **bee assassin** is a large, stout-bodied assassin bug marked with red and black. It is most commonly seen waiting on plants, often at the base of flowers, ready to ambush visiting bees or other flying insect.

Assassin bugs are distinguished by an elongated head, tipped with a short beak used for piercing prey. With most species the front legs are slightly more developed, modified for grasping insects. About 5 species have been recorded from the Site. In addition to the bee assassin, among the more commonly encountered is the **spined assassin bug** (*Sinea diadema*), a predator of caterpillars, and **ambush bugs** (*Phymata* spp.), which may be found camouflaged among flowers in mid-late summer.



Bee assassin feeding on blister beetle.



Spined assassin bug.



Mating pair of ambush bugs.

Hemiptera: Reduviidae

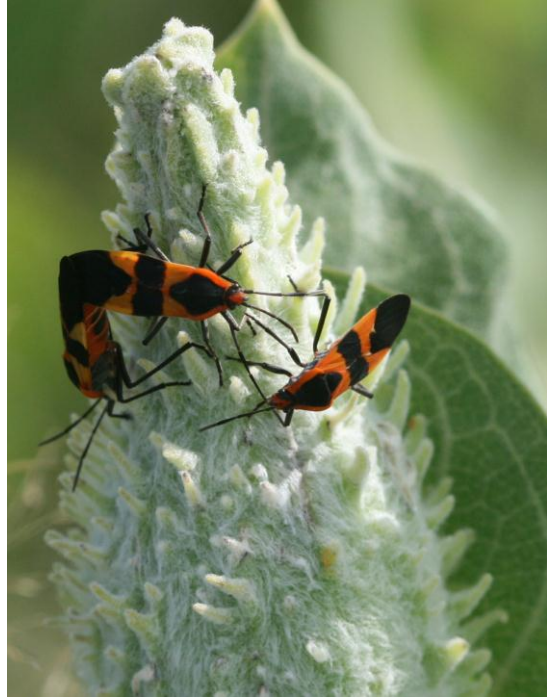
Milkweed Bugs

The **large milkweed bug** (*Oncopeltus fasciatus*) is one of the most conspicuous of the “true bugs” found at the site. The insects are brightly colored orange and frequently the immature stage nymphs can be found massed on fruiting milkweed plants in summer. Milkweeds are the sole host plant for these insects, which primarily feed on the developing seeds.

More widespread is the **small milkweed bug** (*Lygaeus kalmii*) a smaller species marked with black, red and white. Despite its common name, this insect has a very wide range of plants on which it feeds, including many of the common broadleaf weeds associated with agricultural areas of eastern Colorado.



Small milkweed bug.



Larger milkweed bug adults (top) and nymphs (bottom).

Hemiptera: Lygaeidae

Grasshoppers

Sand Creek Massacre National Historic Site with its varied grasslands supports a rich diversity of grasshoppers, with at least 60 species recorded. All feed on plants but each species has its own range of host plants on which it develops. Some have fairly general feeding habits and may be found widely distributed throughout the Site. Others have very specific associations with certain broadleaved plants and are found in localized patches where these plants grow.



Trachyrachys kiowa, the Kiowa rangeland grasshopper.



Specklewinged rangeland grasshopper (*Arphia conspersa*), a species that spends winter in the nymphal stage

Grasshoppers lay their eggs in the soil, as small masses in the form of egg pods. Most species lay their eggs in summer and early fall, with eggs hatching the following spring. However, a few species of grasshoppers survive winter as nymphs: the **velvetstriped grasshopper** (*Eritettix simplex*), **northern greenstriped grasshopper** (*Chortophaga viridifasciata*) and **specklewinged rangeland grasshopper** (*Arphia conspersa*) are examples. In these species adults may be present in late

winter. In spring or early summer they lay eggs that hatch in late summer. Regardless of life cycle, all grasshoppers at the Site complete their life cycle in a year.

The largest grasshoppers are the **plains lubber** (*Brachystola magna*), **green bird grasshopper** (*Schistocerca lineata*), **red shanks grasshopper** (*Xanthippus corallipes*) and **magnificent grasshopper** (*Hadrotettix magnificus*). These are grasshoppers that may exceed 5-cm. Others have unusual markings and patterning. The **great crested grasshopper** (*Tropidolophus formosus*) and **green fool grasshopper** (*Acrolophitus hirtipes*) are large



Green fool grasshopper (*Acrolophitus hirtipes*).

green species with arching crests behind the head. The most brightly colored is the **pictured grasshopper** (*Dactylotum bicolor*), also known as the “barber pole grasshopper”, which is patterned with black, white and orange-red.



Velvetstriped grasshopper (*Eritettix simplex*), a species that overwinters as a nymph.



Green bird grasshopper (*Schistocerca lineata*).



Plains lubber grasshopper (*Brachystola magna*).

Orthoptera: Acrididae, Romaleidae



Pictured grasshopper (*Dactylotum bicolor*), mating pair.



Great crested grasshopper (*Tropidolophus formosus*).



Two-striped grasshopper (*Melanoplus bivittatus*).



Three-banded range grasshopper (*Hadrotettix trifasciatus*).

Katydids

Katydids are the “longhorned grasshoppers”, with much longer antennae and often more delicate legs than the ubiquitous shorthorned grasshoppers (Acrididae family) that dominate. Katydids are more commonly found in areas of dense vegetation with low growing shrubs. However, they are rarely seen as they are primarily active at night and may be well camouflaged.



Texas bush katydid, *Scudderia texensis*.

Katydids feed on foliage of various plants, particularly shrubs. The sexes can be easily identified as the females have prominent ovipositors with which to lay eggs. Those with long, swordlike ovipositors (*Conocephalus* spp., *Pediodectes stevensonii*) insert eggs in soil; the **Texas bush katydid** (*Scudderia texensis*) attaches eggs to branches.



Pediodectes stevensonii.



Female (top) and male (bottom) of *Conocephalus* katydids.

Orthoptera: Tettigoniidae

Prairie Walkingstick

Diapheromera velii velii

The **prairie walkingstick** may be found in some areas of the Site among dense vegetation. Full-grown females may be about 85 mm and are predominantly green. Males are smaller, thinner-bodied and usually browner in coloration.

Winter is spent in the egg stage, with eggs dropped by the females during late summer. The young walkingsticks feed on various shrubby plants and grasses, with big bluestem (*Andropogon*) reported as the primary food plant. Almost all feeding occurs at night after dark and walkingsticks are rarely observed unless actively sampled by sweeping vegetation. Adults may be found beginning in midsummer.

Also present at the Site is the **Colorado walkingstick** (*Parabacillus coloradus*). This is a smaller, gray species with short antennae.



Mating pair of the prairie walkingstick. A droplet of defensive fluid is present on the prothorax of the female.



Colorado walkingstick/

Phasmatodea: Heteronemiidae

Ground Mantid

Litaneutria minor

Ground mantids are present in the open grassy areas of the Site. They are common insects, but uncommonly seen as their relatively small size (25-32 mm) and camouflage patterning allow them to blend in easily amongst plants and soil. They are most often observed in late summer when adults are present.



Ground mantid/

The ground mantids are predators of other insects that they grab with grasping front legs. They usually hunt on the soil around the base of plants waiting in ambush. They also can run rapidly and make short jumps. Wings of ground mantids often develop incompletely and they remain flightless, although occasionally fully winged forms occur.

As with other mantids found in Colorado, the overwintering stage is eggs that are laid in a mass within a spongy protective package called an “ootheca”. These are laid in late summer, attached to branches, rocks, and other solid substrates. Eggs hatch in spring and the newly emerged mantids are miniatures that immediately seek out insect prey. During the course of about 2-3 months they grow and molt, reaching the adult stage by mid-summer.

Mantodea: Mantidae

Aridland Subterranean Termite

Reticulitermes tibialis

The **aridland subterranean termite** can be found when turning over partially buried pieces of wood or dried cattle manure. Like other termites they are some of the few insects capable of digesting cellulose, a primary constituent of plant cells, and serve as important scavengers in rangeland ecosystems.

The aridland subterranean termite produces a belowground nest that may be deeply buried, below frost line, in a site of suitable moisture. The pale foraging workers may tunnel several dozen meters from the nest to locate plant material but always stay in close contact with soil and never travel exposed above ground. Typically a small foraging group will be seen with some soldier caste termites, which can be distinguished by their large brown head. Soldiers serve to guard the workers from predators, such as ants.



Aridland subterranean termite workers and soldiers/



Winged stages of subterranean termites emerging for mating flight. Photograph courtesy of Jim Kalisch, University of Nebraska.

Winged stages of the aridland subterranean termite emerge in late February and March for mating flights. Males (kings) and females (queens) attempt to pair during these events and initiate new colonies. If successful, the colony will grow slowly but steadily, and may contain over 10,000 workers after 5-10 years.

Isoptera: Rhinotermitidae

Rocky Mountain Wood Tick

Dermacentor andersoni

One of the more unpleasant residents of the Site is the **Rocky Mountain wood tick**. These are most common in the dense grassy areas near water that are frequented by their wild animal hosts, particularly deer. They are concentrated along animal trails, where the ticks will wait atop vegetation, “questing” for a passing host.

The Rocky Mountain wood tick is a “3-host” tick that feeds on a sequence of animal hosts as it develops. Upon hatching from the egg stage, a tiny 6-legged larva seeks out a small rodent for its first blood meal, dropping off after it has fully fed (engorged). The next stage is a larger, 8-legged nymph that also feeds on a small animal host. The final stage adult is most commonly encountered and uses a large animal host, such as a deer, raccoon, or coyote.

Humans may also incidentally acquire adult Rocky Mountain wood ticks although they are not a favored host. Seasonal activity is primarily from March or April for adults, peaking in June or July when high temperatures cause most to go dormant. In some areas of Colorado the Rocky Mountain wood tick is involved in the transmission of some pathogens, including those involved in Colorado tick fever, and Rocky Mountain spotted fever. (Ticks present at the Site are not involved in transmission of Lyme disease.)



Rocky Mountain wood tick/



Engorged adult female tick laying eggs. Photograph courtesy of Jim Kalisch, University of Nebraska-Lincoln.

Acari: Ixodidae

Banded Garden Spider

Argiope trifasciatus

The **banded garden spider** is the largest and most conspicuous orb-weaver spider found at the Site. It builds large webs of concentric design attached to low growing shrubs and grasses. Hanging upside down, the back of the spider is silvery to help blend with the sky while the underside is dark, blending with the ground.

The banded garden spider will feed on all manner of insects that jump or fly into its web. However, it is one of the few spiders that make webs of sufficient strength to snare grasshoppers and these likely make up most of the diet of older spiders.

Males are much smaller than the females and may sometimes be found around the corners of a web. After mating in late summer the female will lay a large egg sac and dies at the end of the growing season. Overwintering occurs as the egg stage with the young spiderlings hatching and dispersing the following spring.



Banded garden spider female (lower left) and male (upper right)/



Banded garden spider, underside view/

Araneae: Araneidae

Common Desert Centipede

Scolopendra polymorpha

The **common desert centipede** is a nocturnal predator, feeding on any arthropods that it can capture. Prey is captured by use of a pair of specialized front legs (maxillipeds) equipped with a poison gland to stun and kill. Larger, older stages may even occasionally capture and kill small reptiles or mammals. As they are sensitive to prolonged drying, the common desert centipede stays hidden under logs, rocks or in other protected sites during the day.



Common desert centipede/

Eggs of the desert centipede are laid in cavities hollowed out under a rock, in decayed wood or other sheltered sites. After egg-laying, the female winds around the eggs until the young have hatched. She continues to guard them until they have molted repeatedly and dispersed. The common desert centipede is long-lived, living for 4 years or more.



Immature stage of the common desert centipede/

The common desert centipede is, by far, the largest centipede commonly encountered in the state, often reaching about 12 cm in length. Coloration is typically light brown to brick but may vary widely. Olive brown, yellow and bluish tints are known to occur among this variably colored species. There is usually one dark stripe running across each segment, lending another common name to this species - “tiger centipede”. They are shy by nature and readily try to escape when disturbed. They can produce a painful bite if handled.

Scolopendromorpha: Scolopendridae